

Amendments to the Claims:

The listing of claims below replaces prior versions of claims in the application:

1. (currently amended): A computer rendering method comprising:
moving a semitransparent plane including a plurality of reflection points relative to an axis; and
rendering an image of the plurality of reflection points at a plurality of positions with respect to the axis such that each said point maps an ~~elongate~~ elongated, continuous image.

2. (original): The computer rendering method as defined in Claim 1, wherein moving the semitransparent plane including the plurality of reflection points relative to the axis comprises rotating the plane about, and translating the plane with respect to, the axis.

3. (original): The computer rendering method as defined in Claim 1, wherein moving the semitransparent plane including the plurality of the reflection points relative to the axis comprises moving the plane of the reflection points perpendicular with respect to the axis.

4. (original): The computer rendering method as defined in Claim 3, wherein moving the semitransparent plane including the plurality of the reflection points perpendicular with respect to the axis further comprising rotating the plane about, and translating the plane with respect to, the axis.

1
2 5. (original): The computer rendering method as defined in Claim 1,
3 wherein rendering the image comprises rendering a 3D model from a combination
4 of images of the plurality of reflection points at a plurality of positions with
5 respect to the axis.

6
7 6. (previously presented): The computer rendering method as defined
8 in Claim 1, wherein:

9 a plurality of control points, each being located at an intersection of two
10 axes, define a three-dimensional (3D) surface of a macrostructure;

11 moving the semitransparent plane including the plurality of reflection
12 points relative to the axis further comprises rotating and translating the plane of
13 the reflection points respectively about and along each said axis of the 3D surface
14 of the macrostructure; and

15 rendering the image of the plurality of reflection points further comprises
16 rendering a 3D model from a plurality of images of a plurality of positions of the
17 planar plurality of reflection points with respect to each said axis of the 3D surface
18 of the macrostructure.

19
20 7. (original): A computer-readable media comprising computer-
21 executable instructions for performing the computer rendering method as recited
22 in Claim 1.

23
24 8. (original): A modeling method comprising:
25

1 generating a macrostructure for a three-dimensional (3D) object defined by
2 a plurality of axes; and

3 applying a semitransparent microstructure, defined by planar plurality of
4 reflection points, to the macrostructure by moving the plane of the reflection
5 points with respect to each said axis to yield a 3D model.

6
7 9. (original): The modeling method as defined in Claim 8, wherein
8 moving the plane of the reflection points with respect to each said axis comprises
9 rotating the plane about, and translating the plane with respect each said axis while
10 perpendicular thereto.

11
12 10. (original): The modeling method as defined in Claim 8, wherein the
13 microstructure simulates a cross section of a material selected from the group
14 consisting of:

15 human hair;

16 animal fur;

17 yarn; and

18 foliage.

19
20 11. (original): The modeling method as defined in Claim 8, wherein the
21 yield of the 3D model comprises rendering the 3D model from a combination of
22 images of the plurality of reflection points at a plurality of positions with respect
23 to the axes.
24
25

1 12. (original): A computer-readable media comprising computer-
2 executable instructions for performing the modeling method as recited in Claim 8.

3
4 13. (original): A method for rendering knitwear, the method
5 comprising:
6 generating a macrostructure for a three-dimensional (3D) object defined by
7 a plurality of intersecting axes;
8 applying a stitch pattern to each said axis; and
9 applying a semitransparent lumislice to each said stitch pattern to yield a
10 3D knitwear model.

11
12 14. (original): The method as defined in Claim 13, wherein applying the
13 semitransparent lumislice to each said stitch pattern comprising translating and
14 rotating the lumislice perpendicular to and respectively along and about each stitch
15 of the stitch pattern applied to the plurality of intersecting axes.

16
17 15. (original): The method as defined in Claim 13, wherein the yield of
18 the 3D knitwear model comprises rendering the 3D model from a combination of
19 images of the lumislice at a plurality of positions with respect to the axes, wherein
20 the 3D knitwear model accounts for reflective interactions among the lumislices at
21 different locations on the macrostructure.

22
23 16. (original): The method as defined in Claim 15, wherein the
24 accounting of the 3D knitwear model for reflective interactions among the
25

1 lumislices at different locations on the macrostructure includes at least one of the
2 following:

3 occlusion;

4 shadowing; and

5 multiple scattering among yarn fibers defined by the lumislices.

6
7 17. (original): A computer-readable media comprising computer-
8 executable instructions for performing the rendering method as recited in Claim
9 13.

10
11 18. (original): A method for rendering knitwear, the method
12 comprising:

13 generating a macrostructure, the macrostructure being defined by the
14 plurality of axes connecting a plurality of control points, each said control point
15 being situated at an intersection of at least two of the axes, the plurality of axes
16 defining a three-dimensional (3D) object;

17 applying a stitch pattern to each said axis; and

18 applying a yarn microstructure, defined by a planar plurality of reflection
19 points, to each stitch of the stitch pattern applied to each axis defining the 3D
20 object by rotating and translating the plane of the reflection points perpendicular
21 with respect to each said axis to yield a 3D knitwear model.

22
23 19. (original): The method as defined in Claim 18, wherein generating
24 the macrostructure is further based on a color pattern.

1 20. (original): The method as defined in Claim 18, wherein generating
2 the macrostructure comprises:

3 defining a 3D surface with the control points, the 3D surface being
4 partitioned into quadrilaterals in accordance with the 3D object and corresponding
5 to the stitch pattern; and

6 for each quadrilateral of the 3D surface, connecting a plurality of key points
7 of the quadrilateral with curved segments to yield a stitch loop, the 3D surface
8 resulting in the macrostructure.

9
10 21. (original): The method as defined in of Claim 20, wherein
11 generating the macrostructure is further based on a color pattern, and further
12 comprises, for each curved quadrilateral of the 3D surface, applying a color from
13 the color pattern.

14
15 22. (original): The method as defined in of Claim 18, further
16 comprising, prior to generating the yarn microstructure, introducing irregularities
17 in stitch positions of the stitch pattern of the macrostructure.

18
19 23. (previously presented): The method as defined in Claim 18, wherein
20 the applying the yarn microstructure comprises:

21 for each stitch of a plurality of stitches of the stitch pattern of the
22 macrostructure,

23 for each curved segment of a plurality of curved segments of each said
24 stitch,

25 applying the yarn microstructure to the curved segment.

1
2 24. (original): The method as defined in Claim 18, wherein the 3D
3 knitwear model accounts for reflective interactions among the planar plurality of
4 reflection points at different locations on the macrostructure.
5

6 25. (original): The method as defined in Claim 24, wherein the
7 accounting of the 3D knitwear model for reflective interactions among the planar
8 plurality of reflection points at different locations on the macrostructure include at
9 least one of the following:

10 occlusion of yarn of yarn microstructure;
11 shadowing of yarn of yarn microstructure; and
12 multiple scattering among yarn fibers of yarn of yarn microstructure
13 defined by the lumislices.
14

15 26. (original): A computer-readable media comprising computer-
16 executable instructions for performing the rendering method as recited in Claim
17 18.
18

19 27. (currently amended): A computer rendering method comprising:
20 moving a plurality of voxels contained within parallel opposing planes with
21 respect to an axis that is perpendicular to the parallel opposing planes, each said
22 voxel being semitransparent and having a reflectance factor and a plurality of
23 reflection points having a density; and
24
25

1 rendering an image of the plurality of voxels at a plurality of positions with
2 respect to the axis such that at least one said point maps an ~~elongate~~ elongated,
3 continuous image.
4

5 28. (original): The method as defined in Claim 27, wherein moving the
6 plurality of voxels contained within parallel opposing planes with respect to the
7 axis comprises rotating the parallel opposing planes about, and translating the
8 parallel opposing planes with respect to, the axis.
9

10 29. (original): The method as defined in Claim 27, wherein moving the
11 plurality of voxels contained within parallel opposing planes with respect to the
12 axis comprises moving the plurality of voxels contained within parallel opposing
13 planes perpendicular with respect to the axis.
14

15 30. (original): The method as defined in Claim 29, wherein moving the
16 plurality of voxels contained within parallel opposing planes perpendicular with
17 respect to the axis further comprises rotating the plurality of voxels contained
18 within parallel opposing planes about, and translating the plurality of voxels
19 contained within parallel opposing planes with respect to, the axis.
20

21 31. (original): The method as defined in Claim 27, wherein:
22 rendering the image comprises rendering a 3D model from a combination
23 of images of the plurality of reflection points at a plurality of positions with
24 respect to the axis; and
25

1 the rendered image accounts for the interaction of each said reflectance
2 factor of each said voxel with respect to the other voxels of the plurality of voxels
3 at each said position of said plurality of positions.

4
5 32. (original): The method as defined in Claim 27, wherein:
6 a plurality of control points, each being located at an intersection of two
7 axes, define a three-dimensional (3D) surface of a macrostructure;
8 moving the planar plurality of reflection points perpendicular relative to the
9 axis further comprises rotating and translating the plane of the reflection points
10 respectively about and along each said axis of the 3D surface of the
11 macrostructure; and
12 rendering the image of the plurality of reflection points further comprises
13 rendering a 3D model from a plurality of image of a plurality of positions of the
14 planar plurality of reflection points with respect to each said axis of the 3D surface
15 of the macrostructure.

16
17 33. (original): The method as defined in Claim 27, wherein each of the
18 voxels has an associated opacity and voxel reflectance function (VRF).

19
20 34. (original): The method as defined in Claim 33, wherein:
21 the VRF represents the brightness of a voxel viewed from direction
22 $V(\theta_v, \phi_v)$ when illuminated by a unit intensity light from direction $L(\theta_l, \phi_l)$;
23 the VRF is represented by a four-dimensional color array after
24 discretization of the four angles $\theta_l, \phi_l, \theta_v, \phi_v$;
25 θ is a longitude angle; and

1 ϕ is an altitude angle.

2
3 35. (original): The method as defined in Claim 34, wherein:
4 the discretization of the four angles $\theta_l, \phi_l, \theta_v, \phi_v$ comprises the discretization
5 into directional increments;
6 the directional increments for the longitude angle are $\theta \in [0, 2\pi]$; and
7 the directional increments of the altitude angle are $\phi_l \in [-\pi/2, \pi/2]$.

8
9 36. (original): A computer-readable media comprising computer-
10 executable instructions for performing the rendering method as recited in Claim
11 27.

12
13 37. (original): A method for rendering knitwear, the method
14 comprising:
15 generating a macrostructure for a three-dimensional (3D) object defined by
16 a plurality of intersecting axes;
17 applying a stitch pattern to each said axis;
18 applying a yarn microstructure, defined by a plurality of voxels contained
19 within parallel opposing planes, to the macrostructure by translating and rotating
20 the plurality of voxels contained within parallel opposing planes perpendicular
21 respectively along and about each stitch of the stitch pattern applied to each said
22 axis, wherein each said voxel is semitransparent and has a reflectance factor and a
23 plurality of points having a density; and
24 rendering a 3D knitwear model from a combination of images of the
25 plurality of voxels at a plurality of positions with respect to the plurality of axes.

1
2 38. (original): The method as defined in Claim 37, wherein generating
3 the macrostructure is further based on a color pattern.
4

5 39. (original): The method as defined in Claim 37, wherein:
6 the plurality of axis connects a plurality of control points each being located
7 at an intersection of two of the axes; and
8 generating the macrostructure comprises:
9 defining a 3D surface with the control points, the 3D surface being
10 partitioned into quadrilaterals in accordance with the 3D object and corresponding
11 to the stitch pattern; and
12 for each quadrilateral of the 3D surface, connecting a plurality of key points
13 of the quadrilateral with segments to yield a stitch loop, the 3D surface resulting in
14 the macrostructure.
15

16 40. (original): The method as defined in of Claim 39, wherein
17 generating the macrostructure is further based on a color pattern, and further
18 comprises, for each quadrilateral of the 3D surface, applying a color from the
19 color pattern.
20

21 41. (original): The method as defined in of Claim 37, further
22 comprising, prior to translating and rotating a plurality of voxels contained within
23 parallel opposing planes, introducing irregularities in stitch positions of the stitch
24 pattern of the macrostructure.
25

1 42. (original): The method as defined in Claim 37, wherein applying the
2 yarn microstructure, defined by the plurality of voxels contained within parallel
3 opposing planes, to the macrostructure by translating and rotating the plurality of
4 voxels contained within parallel opposing planes perpendicular respectively along
5 and about each stitch of the stitch pattern applied to each said axis comprises:

6 for each stitch of a plurality of stitches of the stitch pattern of the
7 macrostructure,

8 for each curved segment of a plurality of curved segments of each said
9 stitch,

10 applying the yarn microstructure by translating and rotating the
11 plurality of voxels contained within parallel opposing planes perpendicular
12 respectively along and about each of the curved segments.

13
14 43. (original): The method as defined in Claim 37, wherein the 3D
15 knitwear model accounts for reflective interactions from the reflectance factor of
16 each of the voxels of the yarn microstructure applied to the macrostructure.

17
18 44. (original): A computer-readable media comprising computer-
19 executable instructions for performing the rendering method as recited in Claim
20 37.

21
22 45. (original): A machine-readable medium having instructions stored
23 thereon for execution by a processor to perform a method for rendering knitwear,
24 the method comprising:

1 generating a parameterized surface describing a three-dimensional (3D)
2 knitwear macrostructure;
3 determining a plurality of control points that define the parameterized
4 surface, wherein each said control point is located at an intersection of two axes;
5 applying a stitch pattern to each of the control points of the knitwear
6 skeleton to form a skeleton of the yarn stitches;
7 discretizing the skeleton of the yarn stitches into a plurality of discretized
8 yarn segments;
9 sorting the discretized yarn segments according to a viewing condition of a
10 scene including the knitwear macrostructure and a distance of a view of the scene;
11 inputting the plurality of discretized yarn segments into:
12 a geometry of the scene; and
13 a lighting condition of the scene;
14 applying a lumislice, with respect to a resolution of the distance of the view
15 of the scene and a sampling density, to each stitch of the stitch pattern of the
16 sorted discretized yarn segments by translating and rotating the lumislice
17 perpendicular to and respectively along and about each stitch of the stitch pattern
18 applied to the plurality of intersecting axes, wherein the lumislice is
19 semitransparent and is computed from a fiber distribution of a yarn cross-section;
20 and
21 rendering a synthesis of the scene including the knitwear macrostructure
22 using the sorted discretized yarn segments having the lumislice applied thereto, the
23 viewing condition of the scene, and the distance of the view of the scene.
24
25

1 46. (original): The medium of Claim 45, wherein applying a stitch
2 pattern to each of the control points of the knitwear skeleton to form a skeleton of
3 the yarn stitches further comprises applying a color pattern to each of the control
4 points of the knitwear skeleton to form the skeleton of the yarn stitches.

5
6 47. (original): The medium of Claim 45, further comprising, before
7 applying the lumislice, computing a shadow map from the geometry of the scene
8 and the lighting condition, wherein the synthesis of the scene is rendered using the
9 computed shadow map.

10
11 48. (original): The medium of Claim 45, wherein:
12 each said lumislice characterizes attributions of a cross-sectional slice of
13 yarn of the yarn stitches that is divided into voxels; and
14 each of the voxels has an associated opacity and voxel reflectance function
15 (VRF).

16
17 49. (original): The medium as defined in Claim 48, wherein:
18 the VRF represents the brightness of a voxel viewed from direction
19 $V(\theta_v, \phi_v)$ when illuminated by a unit intensity light from direction $L(\theta_l, \phi_l)$;
20 the VRF is represented by a four-dimensional color array after
21 discretization of the four angles $\theta_l, \phi_l, \theta_v, \phi_v$;
22 θ is a longitude angle; and
23 ϕ is an altitude angle.

24
25 50. (original): The medium as defined in Claim 49, wherein:

1 the discretization of the four angles $\theta_l, \phi_l, \theta_v, \phi_v$ comprises the discretization
2 into directional increments;

3 the directional increments for the longitude angle are $\theta \in [0, 2\pi]$; and

4 the directional increments of the altitude angle are $\phi \in [-\pi/2, \pi/2]$.